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Gentlemen, start your engine: U.S. Navy, Air Force develop engine modification that may save billions

From left, Petty Officer 2nd Class Jason Perreault, Petty Officer 2nd Class Michael Richards and Seaman Recruit William Cumming, from Fleet Air Reconnaissance Squadron 4 (VQ-4) located at Tinker Air Force Base, Okla., preflight one of four CFM56 engines on the E-6B Mercury on the flightline at Naval Air Station Patuxent River, Md. (U.S. Navy photo by Kelly Schindler)

NAVAL AIR SYSTEMS COMMAND, PATUXENT RIVER, Md. – The U.S. Navy and Air Force stand to save more than $2 billion after jointly developing an engine modification that will keep critically important aircraft flying for years.

The two services and industry worked together to develop and field a modification to CFM International's CFM56-2 (F108) engine, allowing them to restore exhaust gas temperature margins, increase fuel economy and extend their time between overhauls from 10 to 15 years.

The CFM56 engines are used on the Navy's E-6B Mercury command and control aircraft and the Air Force's C-135 series tankers and reconnaissance aircraft. The E-6B is managed by the E-6B Airborne Strategic Command, Control & Communications Program Office, PMA-271.

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CFM International (CFM), the engine's maker, is scheduled to receive the Federal Aviation Administration (FAA) certification of the engine modifications by the end of May, Navy officials said.

"As incredible as these achievements are, both the Navy and the Air Force were struggling to reclaim lost engine efficiency," said Andy Noble, the Navy's CFM56 propulsion engineer. "In our case, only half of the engine life was being regained after the first overhaul. We could not gain back the performance we saw with the original engine build. Even with improved build techniques and test cell procedures, we would be doing well to recover half of the original time on wing between overhauls."

About four years ago, the Navy CFM56 engine team, having exhausted all known means to reclaim lost engine performance, asked CFM to make design improvements.

That effort paid off and resulted in Jeff Bauer, the CFM program manager, submitting a proposal in April 2009 for commercially proven design improvements used in newer models of the CFM56 engine family, Noble said.

"The recommendations proposed by CFM addressed the Navy and Air Force concerns of reclaiming lost engine efficiency, as well as introduced fuel efficiencies that would bring additional benefits," he said.

Realizing incorporating these improvements were too costly for the Navy to implement on its own, the E-6B CFM56-2A engine manager, Gerry Cronkrite, pursued a collaborative effort with Tim Misner, the Air Force's CFM56-2B (F108) engine lead program manager. Their coordination resulted in a plan that could be advantageous to both services.

Empowered with this information, the Navy's E-6B program manager here and the Air Force's Headquarters Air Mobility Command provided authorization to pursue the design improvements in early 2010. They then combined efforts to share the costs of flight and ground testing as well as gathering the necessary data required for FAA certification.

Over the next few months, the updated engine would be tested, overhauled and tested again four times. This extensive barrage of ground testing helped reduce the amount of flight test time required and provided CFM engineers a controlled environment to capture FAA certification data. When the ground tests were complete, the engine was rebuilt and certified ready for flight tests by Navy and CFM engineering.

To help prepare for the upcoming flight testing, Lt. Stephen "Merle" Haggard, a test pilot at Air Test and Evaluation Squadron (VX) 20 here, recommended flying all test points in the Navy E-6 Level "D" flight simulator. Those simulated flights were done in August and September 2011.

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In early December 2011, having met all the readiness review requirements, VX-20 Chief Test Pilot Cmdr. Jason Rider authorized flight-testing to begin. Testing was conducted between Dec. 9 and Jan. 11 through the coordinated efforts of VX-20, Navy Propulsion Engineering and CFM Engineering.

"I was excited and fortunate to have the opportunity to be a part of this joint service engine upgrade program that will provide both the Navy and Air Force huge cost savings over the life of the program," Haggard said. "This was a unique test program for the E-6B test team, requiring the skills of professional test pilots, flight engineers and flight test engineers. The team used Crew Resource Management training to safely operate and maneuver this large multi-engine, multi-piloted aircraft to capture all the performance and operability data required to obtain FAA certification."

Cronkrite and Misner are coordinating acquisition and logistics for the effort, with the plan to incorporate design improvements into the engines at the Oklahoma City Air Logistics Center during depot-level overhauls for Navy and Air Force aircraft in fiscal 2013.

Watch CFM56-2A engine manager Gerry Cronkrite explain the CFM56 engine modifications and how it will save the DoD billions of dollars.